

RESTRICTED CIRCULATION



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Agricultural Memorandum No. 820

THE INFLUENCE OF WEATHER FACTORS UPON COYPU POPULATION

INTRODUCTION

The coypu is an aquatic rodent, native to South America. It was introduced into Great Britain in about 1939 for its fur and about 40 fur farms were set up in East Anglia (Ref. 1). Some coypu escaped to become established in the wild, reaching a population in the early 1960's of around 100,000 for the country as a whole. Following the severe winter of 1962-63 the numbers were drastically reduced, to a level where only a few thousand survived (Ref. 2). This number continued to decline during the rest of the decade, but following a succession of 4 relatively mild winters in the early 1970's gradually increased to about 10,000. Current (1977) population estimates suggest that coypu are again well established in Broadland and their numbers, despite a controlled trapping programme, are increasing.

Coypu cause damage by burrowing into river banks and dykes. If their numbers are small, they can be said to be beneficial, since by feeding on aquatic vegetation they tend to keep waterways open (Ref. 1). They can, however, cause local damage to agricultural crops, particularly in cold, freezing conditions when their aquatic food supply is less easily available. Periods of continuous cold effect the coypu adversely in several ways. They suffer from loss of body heat and frostbite, from which many may subsequently die, their food supply is restricted and by moving away from river banks into the open to find food, they are more easily caught.

Those involved with formulating policies concerning the future control of coypu population would be assisted by an assessment of the meteorological factors which appear to have affected their numbers in the past. They would also be assisted by an indication of whether it would be wise to base their future policies on the assumption that certain conditions which have arisen in the past (eg. the 1962-63 winter), are likely to recur.

COMPARISON BETWEEN CLIMATE OF NATIVE HABITAT AND EAST ANGLIA

The species of coypu found in East Anglia is native to the Sante Fe (Vera) region of Argentina which lies at a latitude of between 30° and 35° south. Figure 1 shows that the Sante Fe area has a similar average winter rainfall to East Anglia (Vera, Argentina 321 mm, East Anglia 309 mm), but with a far greater average summer rainfall (Vera 716 mm, East Anglia 314 mm). The temperature differences between the native and adopted habitats of the coypu are far more marked. Figure 2 shows

values of average daily maximum and minimum temperatures. It may be seen that the maximum values are about 12°C lower in East Anglia for each month of the year, and the minimum value in winter about 8°C lower. It will also be noticed that the average daily maximum temperatures in East Anglia are similar to the average daily minima at Vera. From figures available for Parana $31^{\circ} 44'$ south (height 65 m, 210 ft) the average of the lowest temperature recorded in the coldest month of the year (July) is 0°C , in East Anglia the equivalent figure is -5°C , which is about the lowest ever recorded in Parana.

It would appear that during mild winters the coypu in East Anglia finds itself in conditions only slightly colder than the cooler years of its native habitat but in even moderately severe English winters it seems surprising that the coypu is able to survive at all. It is interesting to note that similar escapes of coypu in Eastern Europe have not resulted in any population increase, and no control measures have been necessary (Ref. 2) presumably because conditions are too severe for their survival.

CRITERIA FOR IDENTIFYING COLD STRESS PERIOD

Observations have suggested that coypu in East Anglia leave the shallow waters of the Broads if cold weather persists. It has been surmised that this movement occurs particularly during periods when the edges of the Broads may be frozen. Papers relating the freezing of lake water to air temperatures have been published, but most of the studies are confined to larger, much deeper lakes (the Broads are only a metre or so deep). The reports also concern themselves with freezing and melting dates for the winter as a whole, after a considerable thickness of ice has built up. Published material concerning the short term freezing and melting of lake ice is more limited, but papers by Bilello (Ref. 3, 4) discuss the problem. The theoretical background to the work is rather complex, and the predictions of ice formation are applied to the MacKenzie River, Canada. Considerable further examination of the theory would be necessary to ascertain how it can be applied to the freezing of the Broads.

However, we may suggest criteria which would specify conditions that the coypu would find distinctly unpleasant, even though they probably do not correspond exactly to the formation of ice on the Broads (the continued presence of an ice cover would clearly depend not only upon the length of time sub-zero temperature prevailed, but also to the actual level to which the temperatures fell (Ref. 5).

Using the programmes developed at the Meteorological Office Headquarters, the following data were extracted from their computerized records. All occasions were listed on which for a given day the maximum air temperature (T_{max}) Morley St Botolph (about 20 km south west of Norwich) was less than 5°C , and the minimum temperature (T_{min}) was less than 0°C . The results appear in table 1. Two winters immediately stand out, namely those of 1974-75 when there were only 2 occasions on which the above conditions occurred, and 1962-63 in which the amazing total of 74 days satisfying these criteria were recorded. In that winter, ignoring one break of 2 days and another of a single day, there was a period of 71 successive days in which minimum air temperatures below 0°C were recorded. Figure 3 shows the number of occasions on which runs of days satisfying the criteria occurred.

It has been suggested by Ellis (Ref. 6) that in 1962-63 the elimination of coypu in the areas of the Broads was virtually complete and that those which did survive were those inhabiting the warmer coastal estuaries. His suggestion is thus, that in the event of a repetition of the conditions of 1962-63, any eradication campaign should be focussed on the estuaries.

It has been reported by Gosling (Ref. 7) that there was a marked decline in coypu population during the spring of 1976. In February of that year there was a period of 15 days in which the criteria $T_{max} \leq 5^{\circ}C$, $T_{min} \leq 0^{\circ}C$ were satisfied, so we might suggest a run of 15 days which satisfy the criteria as a basis for determining the probability of the coypu being placed under similar stress in the future. It is, of course, appreciated that the ability of the coypu to withstand a given cold period is influenced by its physiological conditions at the time, particularly with respect to its stored body fat. This will be influenced by non-meteorological factors, but might also be dependent upon the weather conditions existing some weeks, or even months, before the occurrence of the cold period. Thus summer temperatures may not be irrelevant, because the ability of a juvenile to survive may be dependent upon the condition of its parent. The inability of a juvenile of a few weeks of age to survive periods of cold can effectively remove a whole generation from the population, resulting in a set back of numbers which may take about 18 months to be overcome.

From table 1 we may observe that runs of 10 days or more satisfying the suggested criteria occurred on 11 out of the 18 years of the sample, and runs of 15 days or more occurred on 5 out of the 18 years. The longest break between winters in which the criteria failed to be satisfied was 5 years.

By coincidence, this interval is of interest, because it corresponds with the length of time used as a basis for an eradication strategy suggested by Gosling (Ref. 7). In this he has estimated the number of trappers needed to either contain, reduce or eradicate entirely the coypu population in a period of 5 years, assuming a succession of winters such of those occurring over the period 1971-2 to 1974-5, which were generally more mild than average.

CONCLUSIONS

There appear to be certain difficulties which the biologist encounters in estimating both the current coypu population and in constructing population growth models. These difficulties suggest that it would be wise to treat estimates of the dependence of population changes upon meteorological factors with caution particularly while the possible influence of the conditions preceding the cold winter are not understood. An alternative approach would be for the biologist, through his knowledge of the metabolism of the animal, to develop methods for determining the body heat loss and survival ability of different aged animals. The meteorologist could co-operate in this, but in the meantime the following suggestions are made:-

- (1) Accepting that there was a marked decrease in observed coypu population in spring 1976, we observe that certain meteorological conditions which prevailed at that time occurred over the last 18 years at intervals which never exceeded 5 years. It is suggested that those responsible for population estimates examine the other occasions on which these conditions occurred, namely in 1963-64, 1968-69, 1970-71. "Near misses" occurred in 1958-59 and 1965-66. If it is found that populations also declined in those years, this would confirm that the suggested criteria are suitable as a working base.
- (2) Any policy for control based on an assumption of a recurrence of the conditions of 1962-63 should be discounted.
- (3) Assuming that some form of population control is adopted, from the meteorological point of view, a policy which involves the employment of sufficient trappers to prevent a population increase during mild winters (as in 1971-2 to 1974-5), but which would result in a marked reduction during more moderate winters, would seem worthy of consideration. Alternatively, a more stringent policy, designed

to produce a population reduction even in mild winters, would presumably reduce populations drastically if conditions particularly unfavourable for the coypu arose in the succeeding years.

We are given to understand that the present system is allowing a population increase during mild winters, which is only being temporarily halted during the moderately severe spells of cold weather which occur from time to time. This policy would appear to be unsatisfactory.

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TOPICAL FOOTNOTE

It has been hinted in the above report that the approach of merely correlating the apparent numbers of coypu with rather arbitrarily thought up criteria is somewhat unscientific and is in fact one from which Agro Meteorologists are endeavouring to move away. In this case the amount of effort involved in establishing a more soundly based theoretical model is probably not, from the Agro Meteorologists point of view, worth pursuing. This is largely because there are other factors involved in the overall coypu control strategy which may far outweigh the meteorological considerations. However, to understand the ability of our own native mammals to survive in upland areas requires the construction of such models and so the theoretical approach is worth pursuing. We also might consider the possibility of the establishment in the wild of other exotic species. Currently we hear suggestions in the media concerning the possible re-introduction of the once native beaver, an animal whose natural enemies may now have been eliminated, and which is unlikely to be much concerned about a fortnight or so of rather chilly weather.

Table 1.

Frequency of occurrence of suggested criteria.

Daily $T_{\max} \leq 5.0^{\circ}\text{C}$

$T_{\min} < 0^{\circ}\text{C}$

Winter	* Number of successive days with criteria satisfied
1958-59	14, 5, 1
59-60	12, 4, 1, 1
60-61	6, 3, 1, 1
61-62	8, 6, 5, 4, 4, 3, 3, 2, 1
62-63	71, 3, 1, 1, 1
63-64	1, 10, 1, 16, 1, 1, 2, 4, 3
64-65	5, 2, 5, 4, 4, 5, 1, 7, 1, 7
65-66	3, 5, 1, 3, 1, 14, 9
66-67	1, 1, 3, 9, 2, 2
67-68	4, 4, 12, 8, 6, 6
68-69	5, 12, 1, 19, 1, 1
69-70	5, 4, 3, 11, 4, 2, 8, 1, 7
70-71	3, 15, 9
71-72	1, 4, 1, 1, 3, 2, 4
72-73	3, 3, 3, 2, 1, 4, 3
73-74	1, 7, 1, 1, 3
74-75	1, 1
75-76	2, 1, 4, 15, 2

* 'Near miss' breaks of one or two days in an otherwise continuous run have been included as satisfying the criteria.

Sprowston 1958-1969.

Morely St Botolph 1970-1976.

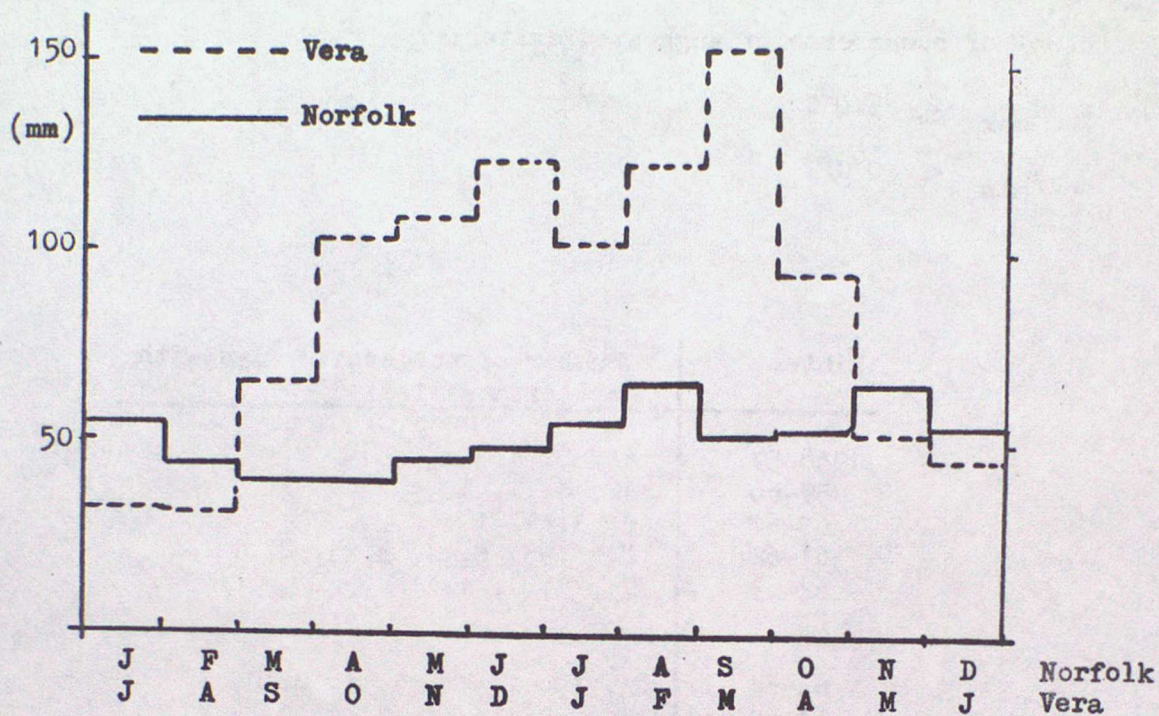


Figure 1. Monthly average rainfall for Vera (Argentina) and Norfolk (Agroclimatic area 24).

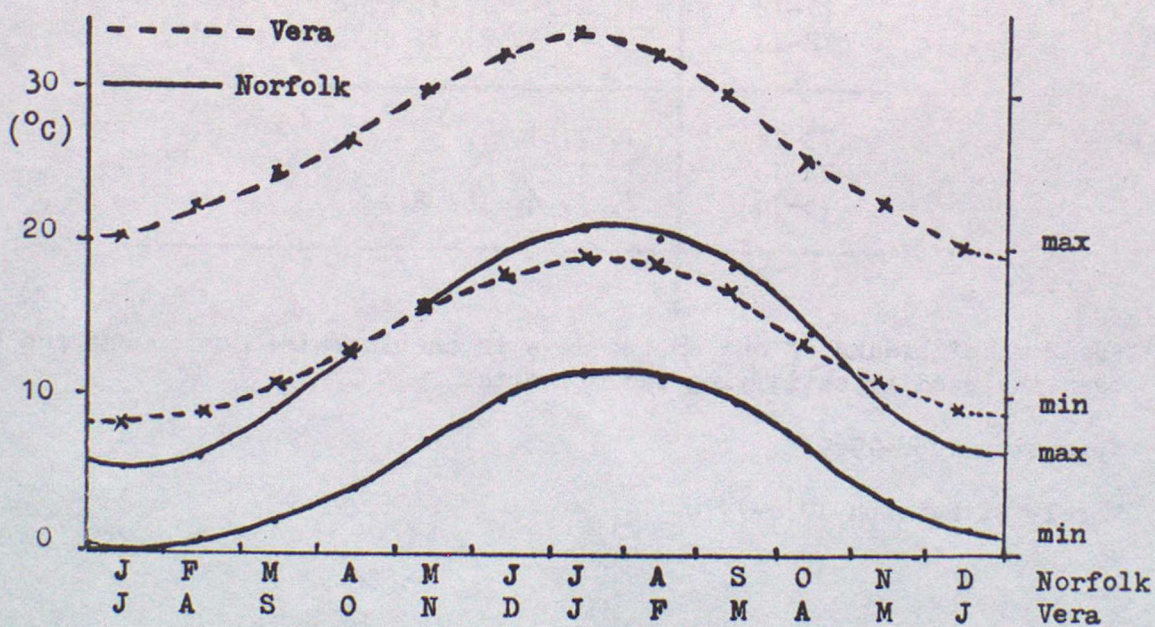


Figure 2. Mean daily maximum and minimum temperatures for Vera and Norfolk.

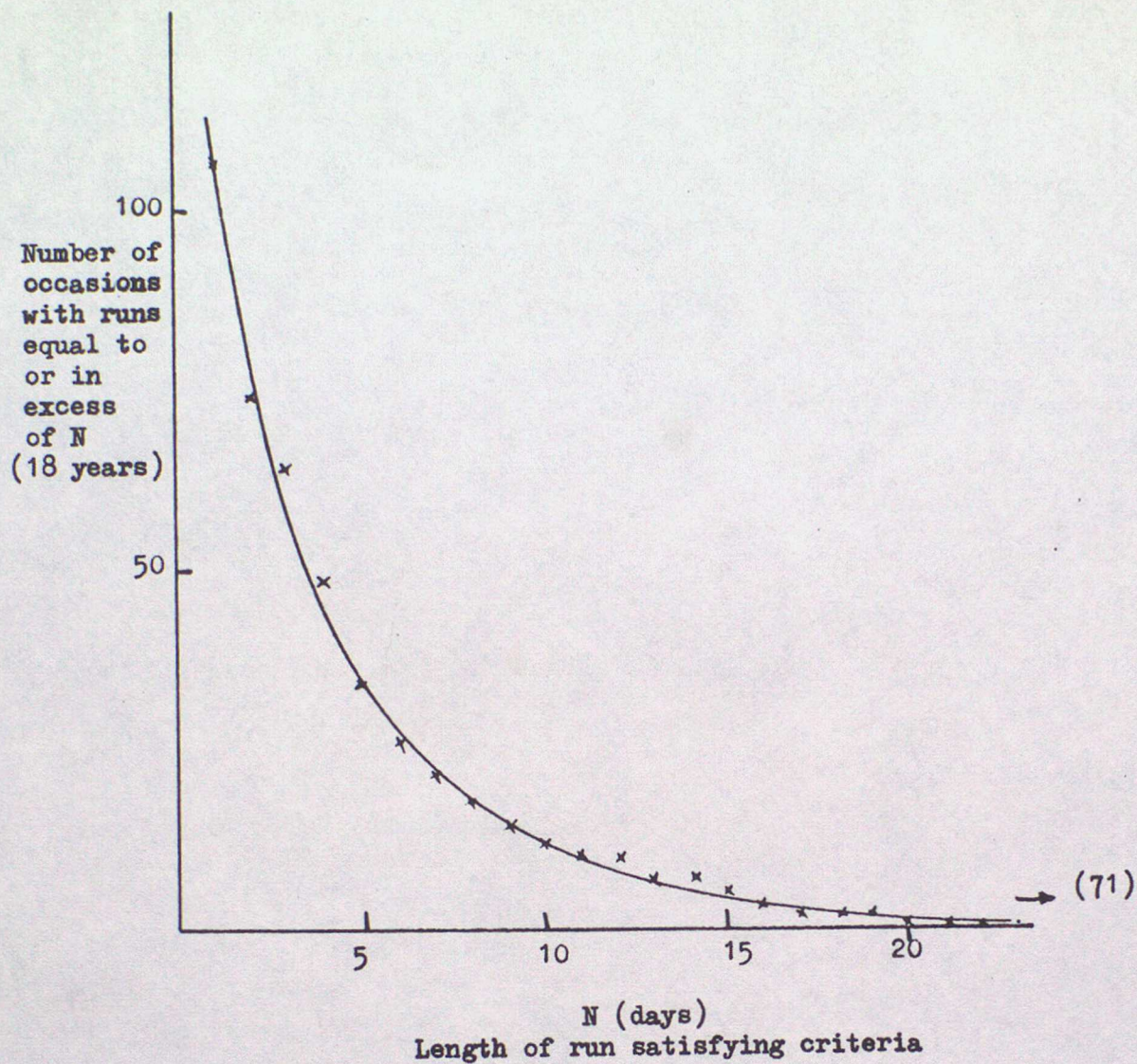


Figure 3. Frequency of occurrence of runs of days satisfying the criteria $T_{\max} \leq 5.0^{\circ}\text{C}$, $T_{\min} < 0^{\circ}\text{C}$.